

IX. *Experiments in which, on the third Day after Impregnation, the Ova of Rabbits were found in the fallopian Tubes ; and on the fourth Day after Impregnation in the Uterus itself ; with the first Appearances of the Fœtus.* By William Cruikshank, Esq. Communicated by Everard Home, Esq. F. R. S.

Read March 23, 1797.

THE ancients imagined that the woman had her testicles, as well as the man, and her own semen. They taught, that in the coitus there was a mixture of the male and female semen in the uterus, and that from a process like fermentation between those two fluids, an embryo was produced. LEWENHOECK said the embryo belonged to the male ; and saw, or thought he saw, animalcules in the male semen, resembling the animals to which they belonged. SPALLANZANI says, that the semen of male animals having no animalcules, impregnates as certainly as that of those which have them. This shows that those animalcules are not embryos. STENO, observing that there were round vesicles in the testicles of women, like the eggs of birds, called them ovaria, and said their structure was exactly similar to the ovaria of birds. After this the immortal HARVEY broached the doctrine of "*omnia ab ovo ;*" that all animals were produced from ova. "*Nos autem asserimus, animalia omnia, et hominem ipsum, ex quibusdam ovis nasci.*"

The ova in the ovaria of rabbits are particularly described by DE GRAAF, whence HALLER calls them ova Graffiana.

But the ovaria of quadrupeds often contain vesicles of the hydatid kind ; and it becomes difficult to distinguish between what are vesicles, and what are ova. The mark with me is this : the ova are inclosed in a capsule highly vascular from arteries and veins, carrying red blood. The hydatid vesicles are not vascular ; at least their vessels carry no red blood. The calyx and the ovum, after impregnation, and even before it, in the state in which the quadruped is said to be *hot*, become black as ink, from the greater derivation of blood ; and the ova resemble dark spots : they also come nearer the surface of the ovarium, so as to pout or project, at last, like the nipple in a woman's breast. Some hours after impregnation, the calyx and the coverings of the ovaria burst, and the ovum escapes ; may fall into the general cavity of the abdomen, and form an extra-uterine foetus ; but almost always falls into the mouth of the fallopian tube, whose fimbriæ, like fingers, grasp the ovarium, exactly at the place where the ovum is to escape. What the appearance of the ovum was, when deprived of its calyx, or when descending the fallopian tube, was not known. DE GRAAF discovered this in the fallopian tubes of rabbits, in the year 1672 ; and says, "*minutissima ova invenimus, quæ licet perexigua, gemina, tamen, tunica, amiciuntur ;*" and then adds, "*hæc quamvis incredibilia, nobis demonstratu facillima sunt.*"

DE GRAAF had the fate of Cassandra, to be disbelieved even when he spoke the truth ! Dr. HUNTER had his doubts ; and the great HALLER, of whom I have always spoke in the language of Professor MARRHAR, "*cujus auctoritas apud me plus valet, quam auctoritas omnium aliorum anatomicorum simul sumptorum,*" positively denies their truth. His words are,

“vix liceat admittere”—and afterwards, “denique, quod caput rei est, neque HARTMANNUS cum experimenta GRAFFIANA iteravit; neque VALISNERUS tot et tam variis in bestiis; neque ego in pene centum experimentis; neque nuperiorum anatomie quispian, vesiculam, quales sunt in ovariis, post conceptionem, aut in tuba vidimus aut in utero!”

In the beginning of summer 1778, I was conversing with Dr. HUNTER on this subject, and said, “I should like to repeat those experiments, now that lectures are over, and that I have the summer to myself.” “You shall make the experiments,” said he, “and I shall be at all the expence.” Accordingly he carried me to Chelsea, introduced me to a man who kept a rabbit warren, and desired him to let me have as many rabbits as I pleased. I made the experiments; and shall now lay a copy of my journal, then made, before this Society.

EXPERIMENT I.

May 30, 1778. I took a female rabbit, hot, (as the feeders term it) that is, ready to be impregnated, and disposed to receive the male. This they find out, not by exposing her to the male, but by turning up the tail, and inverting part of the vagina: its orifice and internal surface are then as black as ink, from the great derivation of blood to these parts. Having run the point of a double-edged dissecting knife through the spinal marrow, between the atlas and dentata, she instantly expired. I preferred this method of killing her, because when the circulation stopped, the internal parts would be found, respecting vascularity, exactly as in the living body. Upon examination some time after, I found the internal parts of

generation, exactly in the same state as the external; that is, as black as ink: the ovaria had, immediately under their external surfaces, a great number of black, round, bloody spots, somewhat less than mustard seeds. These black spots are the calyces or cups which secrete the ova; they are extremely vascular; the ova themselves are transparent, and carry no visible blood vessels. These calyces, on the expulsion of the ova, enlarge and become yellow, projecting above the external surface of the ovaria, and form the *corpora lutea*; a certain mark of conception in all quadrupeds, and in women themselves, whether the embryo is visible or not. The use of the *corpora lutea* is not yet made out; but the orifice, through which the ovum bursts into the fallopian tube is often extremely manifest, and always has a ragged border, as lacerated parts usually have. The fallopian tubes, independent of their black colour, were twisted like wreathing worms, the peristaltic motion still remaining very vivid; the fimbriæ were also black, and embraced the ovaria (like fingers laying hold of an object) so closely, and so firmly, as to require some force, and even slight laceration, to disengage them.

EXPERIMENT II.

I opened a female rabbit two hours after she received the male: the black bloody spots (just mentioned) now projected much above the surfaces of the ovaria, some of the ruptured orifices were just visible; but in many of these spots there was not the least vestige of an orifice; whence I conclude that they heal very quickly in general. While the animal was yet warm, I injected the arterial system with size coloured with vermilion, whence every thing I had before seen became now

more distinct, and the black spots, which I before conjectured to be congeries of vessels, were now proved to be so.

EXPERIMENT III.

I opened another female rabbit the third day after impregnation: that she was impregnated I could have no doubt, for I never knew impregnation fail if the female was hot, and the male had not been previously exhausted; besides the corpora lutea in the ovaria fully proved it: the appearances were the same as in the last, only the *corpora lutea* were larger; but though I examined the fallopian tubes in the sunshine, and with great care, I could not find any ova, neither in them nor in the horns of the uterus.

EXPERIMENT IV.

I opened another female rabbit the fifth day after conception: the appearances were much the same as in the former animal, only the *corpora lutea* were increased in bulk, but there was not the least vestige of an ovum any where that I could discover. I was now ready to exclaim with HALLER, “vix liceat admittere.”

EXPERIMENT V.

I opened another female rabbit on the eighth day after she had admitted the male: the ova were in the cavity of the uterus, and projected through its substance about the size of a large garden pea; when I cut off the most superior part, and cut into the cavities of the ova, the *liquor amnii* escaped in a proportionate quantity; by their adhesions to the internal surface of the uterus they remained extended, not collapsing in

the smallest degree; the foetus was not visible; but I had often made the chick, in my experiments on the incubated egg, become visible, by dropping on the spot, where I knew it must be, a drop of distilled vinegar; by dropping the vinegar on the bottom of the little cups I had made, by cutting off the tops of the cells, the foetus instantly became visible.

EXPERIMENT VI.

Opened another, ninth day: foetus contained within its amnion, floats in another fluid, between chorion and amnion, which are now at a considerable distance; this fluid jellies in proof spirit. Some *corpora lutea* have cavities, others none, nor the least appearance of orifice. The *corpora lutea* keep increasing as the foetus increases, are of a sand-red colour, and very vascular.

EXPERIMENT VII.

Opened a doe the eleventh day after coitus: ova very little larger than the last, nor the foetus: there were but two ova, though several *corpora lutea*. Some pellucid hydatids appeared hanging on the outside of the fallopian tubes. Could these be ova which had missed the passage? they were vascular: the heart of the foetus was full of blood; the umbilical vessels very distinct, but no chord as yet, contrary to DE GRAAF.

EXPERIMENT VIII.

Opened a doe the fourteenth day: seven *corpora lutea* in one ovary, and one in the other; only two ova in the horns of the uterus, one in each; that in the horn next one of the ovaria with one *corpus luteum* was blighted, and the foetus is visible, even with distilled vinegar; in the other it was increased pro-

portionable to the time; the umbilical chord now for the first time distinct, and the tail detached from the under surface of the uterus; there was something unintelligible about the head, it was bifid on the side next the mouth, with a hole in each extremity; the intestines were now apparent, at least the rectum, as were the lower extremities.

EXPERIMENT IX.

Opened a doe sixth day complete: found the ova loose in the uterus, as described by DE GRAAF, and corresponding nearly to the *corpora lutea*, six in one horn and four in the other; the ova were transparent and of different sizes; they were double, and contained each an internal vesicle, there was a spot on one side in most of them, which I conceived to be the intended point of adherence between them and the uterus; the internal vesicle was not equally in proportion to the external, but in some larger, in others less; I even suspect I saw something of the foetus: a polypous excrescence in the uterus near the orifice of the fallopian tube, had detained four of the ova at that place; others were scattered in the uterus: just where one of these vesicles had become stationary a white vascular belt was beginning to form, and in the middle of this a cavity where the vesicle lay; the inner membrane I take to be amnion, the outer chorion.

EXPERIMENT X.

Opened a doe the seventh day: the ovaria were shrunk; there were something like three *corpora lutea*, but not distinct; there were two polypi or solid excrescences in the left horn of the uterus, but no ova.

EXPERIMENT XI.

The day after a doe had received the male I made a small opening on the left side of the abdomen, got down upon the uterus just where the fallopian tube goes off, tied the left tube close to the uterus, with a view to intercept the ova. The result of this mentioned afterwards.

EXPERIMENT XII.

Opened a doe the seventh day after coitus: ova all fixed and adhering to the uterus, even making a sensible swell in form of belts at different parts; the amnion appeared in some nearer the chorion than in others; the liquor between amnion and chorion very gelatinous, in many others less so. Saw nothing of foetus.

EXPERIMENT XIII.

Opened a doe eighth day after coitus: there were about ten or eleven ova; foetus distinct in almost every one, but not without the application of distilled vinegar for two or three minutes, and afterwards immersed in proof spirit; in some I found the brain, spinal marrow, and vertebræ, forming two columns at some distance; they afterwards gradually approached; for it was in one of the least forward that this was most evident.

EXPERIMENT XIV.

Opened a doe twenty-first day after the coitus: five vessels were seen going out of the navel in one of the foetuses, besides the urachus; the omphalo-mesenteric artery was very distinct,

and divided into two as it came to the mesentery; could not see the urachus or allantois well, nor the membrane to which the omphalo-mesenteric artery goes.

EXPERIMENT XV.

Opened a doe the fifth day after coitus: found the ova loose in the uterus, to the number of six; even these had a lesser coat in the inside, corresponding to amnion. None in the tubes.

EXPERIMENT XVI.

Opened (fourteen days after the operation) the doe whose fallopian tube I tied. The uterus of the right side was the size of the sixth day; the ovarium and uterus had gone backwards as to the process, and there was no appearance of foetus; though placenta was very evident on the left side, there was no appearance of conception in the uterus; no placenta; the fallopian tube was very large, soft, and tender; the ovarium twice the size of that on the other side, red, and covered with extravasated coagulable lymph; there was an hydatid in the course of the tube, containing a clear fluid, but nothing like foetus. I suspect that tying the tube prevented the ova on this side from coming out of the ovarium, and that though they rather increased in the ovarium, the process soon stopped; that the process went on, however, in the other side for a few days, and then stopped likewise: there was universal inflammation about the uterus and colon of the left side, with great quantities of white extravasated coagulable lymph; there was water in the abdomen, and all the appearance of peritoneal inflammation. This process seems to give but little pain, for the animal at the time she was killed was eating and looking as usual.

EXPERIMENT XVII.

Opened a doe the third day after the coitus: the pouting parts of the *corpora lutea* very transparent before the uterus was touched; but as soon as the spermatic and hypogastric arteries were divided, in order to cut out the uterus, they all, as if struck with some shock like electricity, became opaque. The pouting part I believe is the ovum, and stands upon the top of *corpus luteum*; it is very vascular, particularly at its basis, but as soon as perfect, or ready for expulsion, carries no red blood; it continues to grow of itself in utero, without adhering to the uterus for two or three days, then takes root, and becomes very vascular: nothing in the tubes or uterus.

EXPERIMENT XVIII.

Opened another the fourth day in the morning; but it had not conceived, and was in the state of one hot.

EXPERIMENT XIX.

Opened one in the evening of the fourth day: the appearances were little different from those of the fifth morning; the ova were only less dispersed through the uterus, and all accumulated about the orifice of the tubes; the amnion was likewise closer to the chorion.

EXPERIMENT XX.

Opened another at the end of the third day, or rather on the beginning of the fourth: the ovaria were dark brown; the fallopian tubes and uterus almost black, from the great quantity of blood derived to them at this time; I opened this uterus

on the upper edge and in the body, so that the parts all remained turgid; the spermatics and hypogastrics not cut through; the corpora lutea were very vascular, an artery running across ramified from both sides, but particularly spent itself in the centre; the upper part of the corpus luteum, or centre, was a little concave, like the head of a turned small-pöck, but no evident foramen: I believe the ova were gone out, but I could see nothing of them in the tubes nor uterus; the fimbriæ were more vascular than I ever saw them, and wholly covered the ovaria; the peristaltic motion of the tubes was very evident, and greater than ever I had seen it; the inner surface of the horns was graniform, with white spots; this I suppose decidua, or perhaps corpus glandulosum EVERRAHDI. DE GRAAF saw the ova in the tubes this day.

EXPERIMENT XXI.

Opened a rabbit at six days and a half: ova in the horns of the uterus were just begun to fix, but did not adhere by vessels; they were very much enlarged compared with the sixth, and the side next the uterus had a round rough spot in it, now very conspicuous; the chorion and amnion were almost in contact with one another; they were easily turned out of the uterus, which embraced them every where loosely, but at the bottom; the *corpora lutea* now increased exceedingly in vascularity, and nourished by a large vessel running across the tubes; remarkably pale, as having done their duty; the graniform appearance on the uterus internally not observable as in the last.

EXPERIMENT XXII.

Opened a doe the seventh day complete after the coitus: turned out, but with difficulty, one of the ova a little larger than in the last; the substance of the uterus over these ova was become thin and transparent, so at first sight you would imagine it was the ovum naked, neither was this part so vascular as one might have expected, considering the principal change was going on here; the ovum burst the moment it was disengaged from the uterus; a gelatinous coagulable fluid issued out, but no appearance of foetus even in the microscope.

EXPERIMENT XXIII.

Opened another rabbit at the end of the third day: same appearance as in Exp. xx.: searched in vain for the ova on the right side; at last, by drawing a probe gently over the fallopian tube on the left side, before it was opened, more than an inch on the side next the uterus, I pressed out several ova, which seemed to come from about its middle, as I began the pressure there, and the ova did not appear till the very last; the amnion made a centre spot, and appeared small compared to the chorion; no ova in the uterus.

EXPERIMENT XXIV.

Opened another at three days and a half: ovaria had the appearance as if the ova had not yet gone out; however, many of them were found in the uterus, and many in the tubes; I got about six; others were lost, from the great difficulty in slitting up the fallopian tubes without bruising the ova with the fingers or with the point of scissars; there

were eight or nine *corpora lutea* in one ovarium, and two only in the other; on the side of the two I only found one ovum, but twice as large as those on the other side. I observed that the redness of the uterus, depended on not losing much of the animal's blood; for when they had been so killed that much blood was lost, the fallopian tubes at least and ovaria were always pale.

EXPERIMENT XXV.

Opened another rabbit at two days and a half after the coitus: ovaria impregnated, but found no ova in the tubes, nor orifices in the *corpora lutea*.

EXPERIMENT XXVI.

Opened one, third day complete: found about six or seven ova in the fallopian tubes, near their end, or about an inch within the tube, on the side next the uterus: in the microscope the ovum appeared as having three coats; the middle one perhaps becomes allantois or membrana quarta.

EXPERIMENT XXVII.

Opened again another at two days and half: and though there were a great many *corpora lutea*, I could not discover any ova; they were probably too small to be perceived, for on the third day complete some of the ova were not perceptible, till they were put into a fluid, and viewed in the microscope.

EXPERIMENT XXVIII.

Opened one the third day all but two hours: found six ova in one fallopian tube, and seven in the other, which corres-

ponded exactly to the number of *corpora lutea* in each ovarium; the ova had three membranes as before. The circles in the cicatricula of the hen's egg are perhaps similar to these. The ova seem to enlarge in their way down the tube, as a pea swells in the ground before it begins to take root; even in the uterus, for two days, they are either loose and unconnected by vessels, or the vessels are so small as not to be discovered by the microscope. The *corpora lutea* were flatter on the head than I had ever seen them before.

EXPERIMENT XXIX.

I opened another at eight days and a half: every thing more distinct and more advanced than on the eighth day; the heart now visible, and resembling much the appearance of the incubated egg in the forty-eighth hour. There were seven *corpora lutea* in the right ovarium, and but four ova in the right horn of the uterus; there were also three in the left ovarium, though but two ova in the left horn.

GENERAL CONCLUSIONS.

1st. The ovum is formed in, and comes out of the ovarium after conception.

2dly. It passes down the fallopian tube, and is some days in coming through it.

3dly. It is sometimes detained in the fallopian tube, and prevented from getting into the uterus.

4thly. DE GRAAF saw one ovum only in the fallopian tube, "in oviductus dextri medio *unum!*" I saw thirteen in one instance, five in another, seven in another, and three in another, in all twenty-eight.

5thly. The ovum comes into the uterus on the fourth day.

6thly. DE GRAAF did not see the foetus till the tenth day; I saw it on the eighth.

7thly. These experiments explain what is seen in the human female. For,

A. I shew a child, at lectures, which remained in the ovaria till it was the size of the fifth month; its fluids were all wasted, and its solids were hard and compressed into an oval form; it had the chorion and amnion, its chord and placenta.

B. I also have in my possession the uterus and ovaria of a young woman who died with the menses upon her; the external membranes of the ovaria are burst at one place, from whence I suspect an ovum escaped, descended through the tube to the uterus, and was washed off by the menstrual blood.

C. The ovum sometimes misses the fallopian tube, falls into the abdomen, and forms the extra-uterine foetus; this sometimes grows to its full size, labour pains come on at the ninth month, the child may then be taken out alive by the Cæsarean section; or, dying and wasting, but not putrefying, may remain without much inconveniency to the mother for many years.

D. The ovum, although it has gone some way down the fallopian tube, may be arrested in its course and become stationary, and form what is called the fallopian tube case. A remarkable case of this kind is given by Dr. HUNTER, in his book on the gravid uterus, where the tube burst, and the mother bled to death.

E. Lastly; the ovum comes into the uterus, where there is room for its enlargement, and a passage for its exit from the body.

P. S. These experiments have been read, and the preparations and engravings shewn, in the lectures on the gravid uterus, given at Windmill-street, every year since the original date of this journal.

EXPLANATION OF THE PLATE (Tab. IV.)

It was not thought necessary to delineate the whole uterus of the rabbit, as it exactly resembles the uterus of other quadrupeds, consisting of a vagina, common to two horns, two fallopian tubes, and two ovaries. Any one who wishes to see this, may see it in DE GRAAF'S little book, tolerably well executed for the age in which he lived: but I am more concerned in his first appearances of the ova, than in his general anatomy of the uterus of the rabbit; and therefore proceed to explain the copy of a plate previously engraved, nineteen years ago.

The figures marked 3d day, are ova of the fallopian tube, found after impregnation on that day. The three first are of the natural size; the three next are magnified, in the simple microscope. In all of them the chorion and amnion are even now distinct, and in some of them the *allantois*, as I suspect.

The figures marked $3\frac{1}{2}$ day, are ova still more advanced; similar to which I found many in the tubes, many in the horns of the uterus. The three first are of the natural size; the two following are magnified also in the simple microscope.

The figures marked 4th day, are more enlarged ova in the horns of the uterus, loose, not adhering, capable of being

moved from one place to another (after these horns are opened) by the gentlest breath blown through a blow-pipe.

The figures marked 5th day, are ova of the fifth day; still loose in utero, and still capable of being blown with the gentlest breath from one part to another: they resemble the last in every thing, only that they are larger. The three first are of the natural size; the three last magnified, as the former ova.

The figures marked 6th day, are ova found in the horns of the uterus on that day; sensibly larger than the preceding; not adhering, even now, to the internal surface of the uterus, but exactly as the last in this respect. The four first are of the natural size, the three last magnified as before; but, as kept some years, the amnion has receded from the chorion to a considerable degree.

The figures marked 7th day, are ova of the seventh day: the first shews the ovum in its cell in the horn of the uterus, laid open; the three next are similar ova, taken out of their cells, and resembling the former; the three last are of the same period, and also removed from the uterus, but magnified by the same microscope as the preceding ova. They are seen after having been kept many years, and the secession of the amnion from the chorion is still more apparent and greater.

The figures marked 8th day: the first shows the foetus now first visible to the naked eye by dropping distilled vinegar on it, in one of the cells of the uterus opened. A little above is seen a cell turgid and unopened; and below a cell half divided. The two next figures, in the same line with the foetus mentioned, are foetuses of the same period from other rabbits,

magnified. They show the rudiments of the *vertebræ*, and the first appearance of the *spinal marrow*. The third in the same row is also magnified, it shows also the earlier appearances of the two hemispheres of the brain.

Of the figures marked 9th day, one shows the foetus, now, for the first time, of itself visible to the naked eye, adhering near the tail to the placenta in the closest manner; the navel string as yet too short to be visible, as contrary to DE GRAAF as possible. The second shows the same foetus magnified.

The figure, on the outside of which is No. 10, shows a *fallopian tube*, on one side of the uterus of the rabbit, with its fimbriated orifice opening into abdomen; and its uterine orifice opening into uterus; also the ovarium, and *corpus luteum* in it, projecting above the surface,

3^d day 3½ day 4th day 5th day

... ..

6th day

7th day

8th day

9th day

N^o 10.

